

# **Water in southern Africa and the Middle East**

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A debate began in the late 1980s about the nature, extent, and implications of the links between environmental and resource issues and national and international security. This debate occurred at both the highest policy levels, with participation from officials like General Secretary Gorbachev and President Bush, and at the level of academic analysts, military officers, and concerned nonexperts. Among the questions asked were the role of environmental degradation or resources scarcity in affecting the stability of nations, the connections between access to resources and the aspirations and power of nations, the role of state capacity and institutional ability in dealing with environmental problems, and the role of politics and diplomacy in resolving global and regional resource disputes.

Ignoring for the time being the purely semantic aspects of these debates—about definitions of “security” or “environment” or “state capacity”—resource issues play definitive roles in the actions of states in international and intranational arenas. Nowhere is this more evident than in the area of freshwater resources. The vast majority of renewable runoff of freshwater is “international” in nature—occurring in watersheds that are shared by two or more nations. In arid and semiarid regions, in particular, these international basins are increasingly serving as a focal point of debate, negotiation, and conflict. While there is enormous potential for interstate cooperation over shared water resources, it has proven extremely difficult to reach lasting and comprehensive treaties that allocate water in regions of scarcity. Since such scarcity is likely to increase in the future as populations grow and as economic development increases demands for water, it is urgent that we better understand the connections between scarcity, international competition for water, and the various mechanisms for reducing that competition.

This paper reviews the nature of the international water problem, describes the connection with national and international security, and offer hints from several regions around the world—including the Middle East and southern Africa—about ways of reducing the risks of water-related conflict.

## **Conflicts over shared international rivers**

Fresh water is a fundamental resource, integral to all ecological and societal activities, including the production of food and energy, transportation, waste disposal, industrial development, and human health. Yet freshwater resources are unevenly and irregularly distributed, and some regions of the world are extremely water short. As we approach the 21st century, water and water-supply systems are increasingly likely to be both the objectives of military action and instruments of war as human populations grow, as improving standards of living increase the demand for fresh water, and as global climatic changes make water supply and demand more problematic and uncertain.

Where water is scarce, competition for limited supplies can lead nations to see

access to water as a matter of national security. History is replete with examples of competition and disputes over shared freshwater resources. Below, I describe ways in which water resources have historically been both the objectives of interstate conflict and the ways in which they have been used as instruments of war.

Many rivers, lakes, and groundwater aquifers are shared by two or more nations. This geographical fact has led to the geopolitical reality of disputes over shared waters, including the Nile, Jordan, and Euphrates rivers in the Middle East; the Indus, Ganges, and Brahmaputra in southern Asia; and the Colorado, Rio Grande, and Paraná in the Americas. By looking at indices for measuring the vulnerability of states to water-related conflict, tensions appear especially likely in parts of southern and central Asia, central Europe, and the Middle East, where the history of water-related conflicts already extends back 5000 years (Gleick 1994).

There is a long history of water-related disputes, from conflicts over access to adequate water supplies to intentional attacks on water systems during wars. Water and water-supply systems have been the roots and instruments of war. Access to shared water supplies has been cut off for political and military reasons. Sources of water supply have been among the goals of military expansionism. And inequities in water use have been the source of regional and international frictions and tensions. These conflicts will continue—and in some places grow more intense—as growing populations demand more water for agricultural, industrial, and economic development (Gleick 1993). While various regional and international legal mechanisms exist for reducing water-related tensions, these mechanisms have never received the international support or attention necessary to resolve many conflicts over water. Indeed, there is growing evidence that existing international water law may be unable to handle the strains of ongoing and future problems. In addition to improving international law in this area, efforts by the UN, international aid agencies, and local communities to ensure access to clean drinking water and adequate sanitation can reduce the competition for limited water supplies and the economic and social impacts of widespread waterborne diseases. In regions with shared water supplies, third-party participation in resolving water disputes, either through UN agencies or regional commissions, can also effectively end conflicts.

Interstate conflicts are caused by many factors, including religious animosities, ideological disputes, arguments over borders, and economic competition. Although resource and environmental factors are playing an increasing role in such disputes, it is difficult to disentangle the many intertwined causes of conflict. Identifying potential trouble areas does little good if we have no tools for mitigating the problem. International law for resolving water-related disputes must play an important role, and I outline here recent advances in developing principles for managing internationally shared water resources. Their strengths and shortcomings are also assessed together with their ability to deal with the kinds of uncertainties that will increasingly dominate interstate disputes over water. Not all water-resources disputes will lead to violent conflict; indeed most lead to negotiations, discussions, and nonviolent resolutions. But in certain regions of the world water is a scarce resource that has become increasingly important for economic and agricultural development. In these regions, water is evolving into an issue of “high politics,” and the probability of water-related conflict is increasing. Policymakers and the military should be alert to the likelihood of conflicts over water

resource, and to the possible changes in both international water law and regional water treaties that could minimize the risk of such conflicts. Below I briefly discuss major issues in the Middle East and southern Africa that are urgently in need of resolution.

## **The international waters of southern Africa**

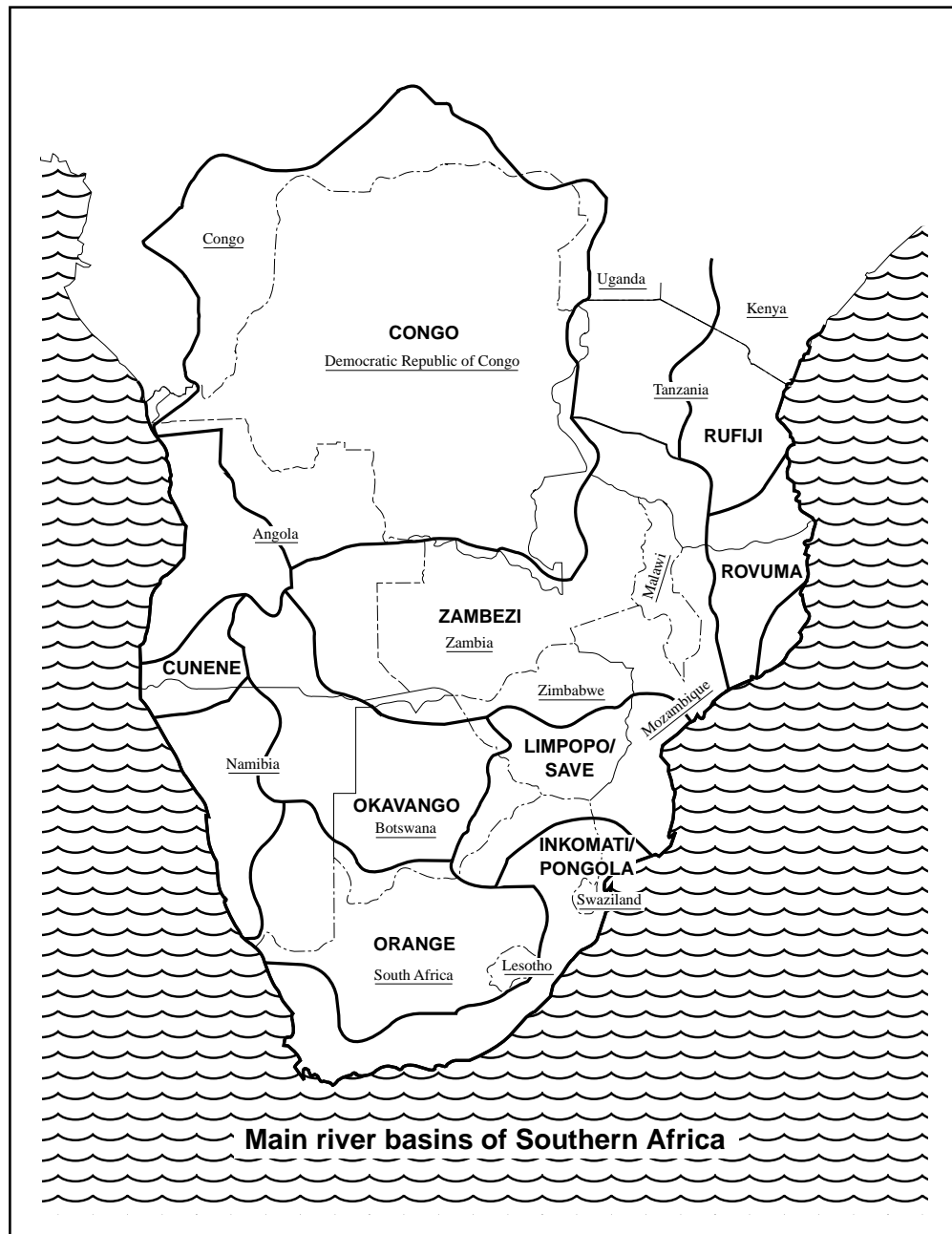
Southern Africa is a geographically, ethnically, and hydrologically diverse region encompassing the 11 countries of Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. The extent and type of water resources in these countries is very mixed, and the types of institutions set up to manage water are varied. Much of the region is semiarid and every major perennial river is shared by two or more nations. Growing populations and growing economic development in the region are putting increasing pressure on these water resources. Combined with the lack of effective joint international management of water, these growing demands are likely to lead to increased political tensions and conflict in the future, although successful international cooperation is also possible if the parties in the region make an effort to bring these issues into diplomatic discussions.

### **Hydrology of southern Africa**

Southern Africa has an extremely variable climate and hydrologic regime. In the SADC region (Southern African Development Community), 22% of the area is considered desert or arid and receives less than 400 millimeters of rain per year, another 35% is semiarid or subhumid. Most precipitation originates from the Indian Ocean and is highly seasonal, with most areas experiencing a five- to seven-month wet season during the October–April summer (Conley 1996). The variability of interannual precipitation is also extremely high, resulting in unpredictable and often severe droughts. Droughts during the 1980s and 1990s have been particularly severe, leading to renewed interest in regional water management and planning.

The entire region is largely dependent on rainfall and river runoff for water supply, and every major perennial river in the region is shared by two or more nations. This characteristic effectively necessitates that international negotiations over the rivers be conducted and that agreements over sharing and allocation be reached. Figure 17-1 shows the main river basins in the region. Tables 17-1 and 17-2 list the international rivers of the states of the SADC region. The Congo River dominates all other rivers on the continent, with nearly 30% of the total river flow of Africa. Despite the size of the Congo, its long distance from the demand centers in the south and the high cost of moving water make it unlikely that it will play much of a role in future water supply considerations in the region. Several other rivers, however, are the focus of disputes. These are summarized below.

The Okavango River. The Okavango River is shared by Angola, Namibia, and Botswana and is the largest endoreic (internally draining) river in southern Africa. Most of the flow originates in Angola, flows southeast to Namibia, along the Namibian-Angolan border and then turns south into Botswana. The river drains in the world-renowned ecosystem in the region—the Okavango Delta. Inflow to the delta averages



**Figure 17-1. Overlap of the river basins and nations of southern Africa.**

about 10,000 million cubic meters ( $m^3$ ) per year. The Okavango Delta has been classified as a World Heritage Site and contains a diversity of flora and fauna unrivaled in Africa.

Several years ago, Botswana proposed a major project called the Southern Okavango Integrated water Development Project, whose main objective was to provide water for irrigators, urban users, livestock, and, in particular, a large mine. International concern about the environmental impacts of this diversion project and the quality of the environmental assessment led to an outside analysis by the International Union for the Conservation of Nature (IUCN), which was skeptical about the need for the project, concerned about its economics, and critical about its environmental implications. Fol-

**Table 17-1. International rivers of the Southern African Development Community region.**

<b>Basin State</b>	<b>Number of International Basins</b>	<b>River Basins</b>
Angola	5	Cunene, Cuvelai, Okavango, Congo, Zambezi
Botswana	5	Limpopo, Nata, Okavango, Orange, Zambezi
Lesotho	1	Orange
Malawi	2	Rovuma, Zambezi
Mozambique	9	Buzi, Incomati, Limpopo, Rovuma, Save, Maputo, Pungue, Umbeluzi, Zambezi
Namibia	5	Cunene, Cuvelai, Okavango, Orange
South Africa	4	Incomati, Limpopo, Maputo, Orange
Swaziland	3	Incomati, Maputo, Umbeluzi
Tanzania	3	Rovuma, Congo, Zambezi
Zambia	2	Congo, Zambezi
Zimbabwe	7	Buzi, Limpopo, Nata, Pungue, Save, Umbeluzi, Zambezi

Source: Ohlsson 1995.

lowing this analysis and the subsequent publicity, the project was put on hold. It is, however, reportedly of interest to Botswana (Conley 1996).

More recently, the relationship between Namibia and Botswana has been strained by Namibian plans to construct a 250-kilometer pipeline to divert water from the Okavango River to eastern Namibia and the capital of Windhoek (James 1996). Namibia, one of three riparians, intends to build an emergency pipeline to connect its Eastern National Water Carrier with the Okavango to help deal with a severe ongoing drought (as of the beginning of the 1996–97 rainy season). This development would extract about 20 million cubic meters of water from the Okavango for urban water needs. While an Okavango River Basin Commission (OKACOM) comprised of Angola, Botswana, and Namibia was formed in September 1994, there is no long-term agree-

**Table 17-2. Southern African river basins and basin states.**

<b>River Basin</b>	<b>Basin States</b>	<b>Basin Area (sq. kilometers)</b>
Buzi	Mozambique, Zimbabwe	30,000
Cunene	Angola, Namibia	110,000
Cuvelai	Angola, Namibia	125,000
Incomati	Mozambique, South Africa, Swaziland	54,000
Limpopo	Botswana, Mozambique, South Africa, Zimbabwe	385,000
Maputo	Mozambique, South Africa, Swaziland	34,000
Nata	Botswana, Zimbabwe	
Okavango	Angola, Botswana, Namibia	585,000
Orange	Botswana, Lesotho, Namibia, South Africa	950,000
Pungue	Mozambique, Zimbabwe	32,000
Rovuma	Malawi, Mozambique, Tanzania	167,000
Save	Mozambique, Zimbabwe	100,000
Umbeluzi	Mozambique, Zimbabwe	5,500
Zambezi	Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe	1,420,000
Congo	Angola, Cameroon, Central African Republic, Congo, Burundi, Rwanda, Tanzania, Democratic Republic of Congo, Zambia	3,800,000

Note: Part of Tanzania is in the Nile River basin, but the Nile is not typically considered a SADC basin. Indeed, the Congo is also rarely considered relevant to SADC water discussions, given its distance from the major demand centers in the region. There is little agreement in the literature about the actual river basin areas. These data come from several sources and are rounded off.

ment over management or allocation of the river and no agreement that this project should go forward. Negotiations and discussions between Namibia and Botswana are continuing, however, and the two countries have signed an agreement to maintain the flow of information, to share detailed feasibility studies, and to apply common principles to those studies (Communiqués, June 27, 1996 and October 15, 1996).

This issue could become the most urgent one in the region, and is already drawing attention from the international community. If the drought continues into 1997 unilateral decision by Namibia to go ahead with construction of the Eastern National Water Carrier is a distinct possibility. Such a decision would be a violation of accepted international principles governing shared international watercourses (McCaffrey 1993). These principles require joint basin management, cooperative agreements over allocations, and jointly conducted assessments to determine the environmental consequences of watershed development. Furthermore it would set a bad precedent for future water withdrawals and allocations from the Okavango by Angola and Botswana.

Conversely, if the rainy season is sufficient to mitigate the ongoing drought, enough pressure could be relieved to permit Namibia, Botswana, and Angola to work through the OKACOM to come up with a satisfactory joint basin management plan. In any case, adequate environmental impact assessments must be done to evaluate not only the impacts of construction, but the consequences of water withdrawals downstream during high and low flows, and during both routine and emergency operations. In addition, the size of the facility should be constrained by the results of the environmental assessment.

Shared rivers of Kruger National Park, South Africa and Mozambique. Six major rivers flow east from the Republic of South Africa into the Kruger National Park and then into Mozambique, where they ultimately form the Limpopo and Incomati rivers (Table 17-3). All six international tributaries are highly utilized outside of the park, and are threatened by growing populations and utilization. Kruger is the most important center for tourism in the southern African region with over 7 million visitors annually (Venter and Deacon 1995) and is one of the largest and most important centers for biodiversity in the area.

**Table 17-3. Rivers of Kruger National Park and Mozambique.**

River Basin	Basin Area (square km)	Natural Flow (million m <sup>3</sup> /yr)
Luvuvhu River	3,568	395
Letaba River	13,400	553
Shingwedzi River	5,600	78
Olifants River	54,575	1,950
Sabie River	7,096	762
Crocodile River	10,526	1,238

Source: Breen et al. 1994.

None of these rivers have formal agreements that guarantee flows for Kruger and Mozambique and new concerns are now being raised about the health and quality of life of populations living in the Limpopo and Incomati watersheds in Mozambique.

The Lesotho Highlands Project. The Kingdom of Lesotho has 100% of its area over 1500 meters elevation. The highest point in Southern Africa is here, at over 3800 meters, and the country also receives the highest rainfall in the region. As a result, the country is the origin of many of the region's rivers, including the Senqu (Orange), the Mohokare (Caledon) and the Tugela. Lesotho, one of the world's poorest countries, is completely surrounded by South Africa, the continent's most affluent nation.

Almost completely devoid of exportable natural resources, Lesotho has one marketable good: water. As a result, South Africa and Lesotho entered into an agreement in the mid-1980s to construct the Lesotho Highlands Project, currently the continent's largest civil engineering works. The project consists of many phases (1A, 1B, 2, 3, and 4), but the overall goal is to divert most of the major tributaries of the Senqu (Orange) River, which flows south out of Lesotho into South Africa, north into the Gauteng Region, which is the industrial heartland of South Africa. If the project is brought to completion, nearly 50% of the country's water will be diverted to South Africa.

South Africa is paying almost all of the construction costs of the project, estimated at over \$2.5 billion for Phase 1A alone (Wallis 1992). Additional support is coming from the World Bank, the European Community, and some European countries. Most of the construction contractors for the project are Italian and French. South Africa will receive all of the water and in return, Lesotho gets an annual payment for the water, consisting of a base sum plus a sum contingent on the amount of water delivered. Lesotho will also receive the power generated from the project.

As with all major dam projects, however, there are a number of costs that will be borne by Basutho people and the environment that have not been clearly evaluated. Rural development in the region, which might have resulted from more careful planning, is being poorly and incompletely handled. Recently, new attention has been focused on the project by local nongovernmental organizations, international environmental groups, and analysts at international aid agencies. Reaction from South Africa and Lesotho has been mixed and defensive, but it seems likely that some changes in the project will be made, and that some phases will be delayed or canceled. Several issues with international ramifications are described briefly below.

- **Minimum environmental flows**—Inadequate studies have been done on the minimum flow requirements needed to support instream ecosystems and no provision has been made to provide such requirements. An endangered minnow lives in the streams to be destroyed by the project and several endangered birds have nesting sites that would be eliminated by the reservoirs of Phase 1. Of seven known minnow populations, four will be destroyed by Phase 1. An instream flow release would reduce the economic viability of the project by decreasing both hydroelectric production and the volume of the water that would flow north into South Africa. Several people from South African water agencies, the SA Ministry of Water Affairs and Forestry, and the SA Water Research Commis-



sion expressed the opinion that Lesotho was willing to do whatever necessary, including, as one analyst put it—"kill every leopard and dry up every stream"—in order to get the financial return from selling the water to South Africa.

- Rural development—There is an agreement to provide some basic services to populations affected by the project. All villages within the watershed of the project are to receive basic drinking water supplies, consisting of standpipes within 150 meters of homes, providing a standard of 30 liters per person per day. Pit toilets are also supposed to be provided for sanitation services. Despite the fact that the first portion of Phase 1 is almost completed, this rural development has not yet begun. The development plans do not include providing electricity to all residents in the affected area despite the fact that hydroelectricity is being produced by the project and exported to other parts of Lesotho.
- Other international concerns—In addition to the international issues related to massive diversions from Lesotho to South Africa, there are concerns in the Orange River basin that the Lesotho Highlands project will deprive Orange River water users (primarily in South Africa) of sufficient water for their own needs. In addition to the Lesotho portions of the basin, the Orange includes parts of central and western South Africa and part of Namibia. Recently, these parties have begun to openly question the further development of the project and call for a re-evaluation of environmental and social impacts downstream. Ultimately, it seems likely that a renegotiation between Lesotho, Namibia, and South Africa will be necessary in order to proceed further with the project.

The Zambezi River. The Zambezi River is a sizable river with an average annual flow larger than that of the Nile. The Zambezi is shared by eight nations and is used for irrigation, hydroelectric production, wildlife refuges, mining, tourism, power plant cooling, and transportation. While it is extremely unlikely that large-scale diversions from the river toward the south will be made for decades, if ever, recent statements from South Africa have rung alarm bells throughout the region. Those statements have suggested that South Africa is thinking about, and may have at least rudimentary plans for, diverting water from the Zambezi through a canal system in Botswana or Zimbabwe to Gauteng province. Yet South Africa is not one of the eight nations comprising the Zambezi watershed. As one South African official pointed out "There are eight countries involved and we would have to talk to all of them. It would be a diplomatic nightmare (Peters 1996)."

## **The international waters in the Middle East**

In the Middle East, ideological, religious, and geographical disputes go hand in hand with water-related tensions, and even those parts of the Middle East with relatively extensive water resources, such as the Nile, Tigris, and Euphrates river valleys, are coming under pressure. Competition over the limited water resources of the area is not new—people have been fighting over, and with, water since ancient times. The problem has become especially urgent in recent years, however, because of growing

demands for water, the limited options for improving overall supply and management, and the intense political conflicts in the region. At the same time, the need to jointly manage the shared water resources of the region may provide an unprecedented opportunity to move toward an era of cooperation and peace.

In the last several years, the problem of water conflicts has merited separate explicit discussion in multilateral and bilateral Middle East peace talks. Among the issues that still need to be resolved are the allocation and control of water and the water rights of the Jordan River and the three aquifers underlying the West Bank; disputes between Syria and Jordan over the construction and operation of a number of Syrian dams on the Yarmuk River; the joint management of the Euphrates River between Turkey, Syria, and Iraq; and how to protect water quality for all riparians.

### **The Jordan River basin**

The Jordan River is one of the most important in the region, and the locus of intense international competition. Shared by Jordan, Syria, Israel, and Lebanon, the Jordan drains an area of slightly under 20,000 square kilometers and flows 360 kilometers from its headwaters to the Dead Sea. Annual precipitation in the watershed ranges from less than 50 mm per year to over 1000 mm per year, and averages less than 200 mm per year (Naff 1992). The upper Jordan is fed by three major springs, the Hasbani (in Lebanon), the Banias (in the Golan Heights), and the Dan (in Israel). The major tributary of the Jordan, the Yarmuk River, originates in Syria and Jordan and comprises part of the border between these countries and the occupied Golan Heights before flowing into the Jordan River.

Since the establishment of Israel in 1948, this basin has been the center of intense interstate conflict, and the dispute over the waters of the Jordan River is an integral part of the ongoing conflict. When Syria tried to stop Israel in the 1950s from building its National Water Carrier, a system to provide water to southern Israel, fighting broke out across the demilitarized zone. When Syria tried to divert the headwaters of the Jordan away from Israel in the mid-1960s, Israel used force, including air strikes against the diversion facilities. These military actions contributed to the tensions that led to the 1967 Arab-Israeli war and the occupation of the West Bank and much of the headwaters of the Jordan River by Israel. Tensions also exist in the Jordan Basin between Syria and Jordan over the construction and operation of a number of Syrian dams on the Yarmuk River, and among all the riparians over water quality.

### **Shared groundwater aquifers**

A significant fraction of Israel's water use comes from shared groundwater aquifers that underlie both the West Bank and the Gaza Strip. By some estimates, 40% of the groundwater upon which Israel is now dependent—and more than a third of its sustainable annual water yield—originates in the occupied territories (Lowi 1990 and Naff 1992). These aquifers are replenished almost entirely by rainfall on the West Bank. The largest of the aquifers, the Western (called the Yarkon-Taninim aquifer in Israel) flows west toward the Mediterranean Sea. This groundwater supply is tapped extensively by Israel, primarily from within the boundaries of pre-1967 Israel. The other

aquifers are also largely controlled and used heavily by Israel, both within Israel proper and in the settlements in the occupied territories.

The control of the waters from these aquifers is one of the major sources of tension between the Palestinians and the Israelis. Among the unresolved questions are the extent to which these three aquifers are used, disputes over their control and management, uncertainties about the effects of large withdrawals on water quality, and arguments over the yields that can be provided safely.

## **The Tigris and Euphrates River basins**

The Tigris and Euphrates rivers are among the largest in the region. Both rivers originate in the mountains of Turkey, flow south through Syria and Iraq, and drain through the Shatt Al-Arab waterway into the Persian Gulf. Several tributaries of the Tigris drain the Zagros Mountains between Iran and Iraq, and 15% of the Euphrates basin is in Saudi Arabia, though essentially none of its flow is generated there. Ninety percent of the water in the Euphrates River (average annual flow of about 33,000 million cubic meters) originates in Turkey, though Turkey only has 28% of the area of the Euphrates Basin. Almost all of the remainder of the flow originates in Syria. Turkey, Syria, and Iraq all have large and rapidly growing populations and all three countries have ambitious plans to increase their withdrawals of water for irrigation.

For 30 years, negotiations over the Euphrates among the three riparians have produced no lasting agreement, in part because Turkey, Syria, and Iraq have long been at odds with each other. For example, Syria and Iraq have opposed Turkey over its membership in a regional military alliance, while Syria and Turkey opposed Iraqi military actions in the 1970s. In the 1980s Turkey and Iraq tended to band together against Syrian military aggression, and Turkey and Syria sided with the allied forces against Iraq during the Persian Gulf war in the early 1990s.

Water-related disputes and military threats over river flows arose in the basin in the 1960s and 1970s after both Turkey and Syria began to draw up plans for large-scale irrigation withdrawals. In 1965, tri-partite talks were held in which each of the three countries put forth demands that, together, exceeded the natural yield of the river. Also in the mid-1960s, Syria and Iraq began bilateral negotiations over formal water allocations, but no formal agreement has been signed.

In the mid-1970s, Iraq alleged that the flow of water in the Euphrates had been reduced by the Syrian dam, threatened to bomb it, and massed troops along the border. In spring of 1975, the tensions between Iraq and Syria reached a peak as the two countries traded hostile statements, closed airspace, and moved troops to their borders. The angry confrontation ended just short of military action after mediation by Saudi Arabia (Gleick 1994).

In the last few years, Turkey's new water-supply projects have been the focus of new political concerns in the basin. Tensions arose in early 1990 when Turkey completed construction of the Ataturk Dam and interrupted the flow of the Euphrates for a month. Just prior to that, in October 1989, Turkish Prime Minister Ozal threatened to restrict water flow to Syria to force it to withdraw support for Kurdish rebels operating in southern Turkey. While Turkish politicians claimed that the subsequent shutoff was entirely for technical, not political reasons, both Syrian and Iraqi officials argue that

Turkey was using its power over the headwaters of the Euphrates for political goals and could do so again. The ability of Turkey to shut off the flow of the Euphrates, even temporarily, was noted by political and military strategists at the beginning of the Persian Gulf conflict. In the early days of the war, there were behind-the-scenes discussions at the United Nations about using Turkish dams on the Euphrates River to cut off water to Iraq in response to its invasion of Kuwait. While no such action was ever taken, the threat of the “water weapon” was again made clear.

## **Institutional issues**

International law in the area of shared water resources is both well advanced and, in what may appear to be a contradiction, largely ineffective. More than 30 years of negotiations and discussions have occurred since the original statement of the 1966 Helsinki Rules governing international waters. In recent years, the International Law Commission (ILC) has refined the basic principles governing shared international watercourses (McCaffrey 1993), but these rules offer little concrete guidance to countries trying to allocate scarce water resources. Developing joint agreements is difficult because of the many intricacies of interstate politics, national practices, and other complicating political and social factors. For nations sharing river basins, factors affecting the successful negotiation and implementation of international agreements include whether a nation is upstream, downstream, or sharing a river as a border, the relative military and economic strength of the nation, and the availability of other sources of water supply.

Among the general principles set forth by the ILC are those of equitable utilization, the obligation not to cause harm to other riparian states, and the obligation to exchange hydrologic and other relevant data and information on a regular basis. Questions still remain, however, about their relative importance and means of enforcement. In particular, defining and quantifying “equitable utilization” of a shared water supply remains one of the most important and difficult problems facing many nations.

More effective than these basic principles have been individually negotiated treaties. Hundreds of different treaties signed by parties to international rivers allocate water, regulate navigation and power, monitor and control water quality, and affect all other aspects of joint management. While each of these treaties tends to be negotiated separately and individually, some have been highly effective at reducing water-related conflicts.

To make both regional treaties and broader international agreements over water more flexible, detailed mechanisms for conflict resolution and negotiations need to be developed, basic hydrologic data need to be acquired and completely shared with all parties, flexible rather than fixed water allocations are needed, and strategies for sharing shortages and apportioning responsibilities for floods need to be developed before shortages become an important factor.

## **Southern Africa’s water institutions and policies**

There are approximately 22 major agreements between the SADC states that affect some aspect of water development, management, and use (Ohlsson 1995). Other

important aspects of the region's water policy are the new water law being prepared for South Africa and joint technical committees that, in theory, are set up to resolve disputes. Below are some of those relevant for the international problems described earlier.

OKACOM 1994. In 1994, Angola, Botswana, and Namibia created a Permanent Okavango River Basin Water Commission to deal with water problems on the Okavango. While this commission seems to be the ideal place to resolve any dispute over allocations and withdrawals from the river, such as those proposed by Namibia through the Eastern National Water Carrier, no such efforts have yet been made, and there seems to be some sidestepping of OKACOM in the recent dispute. Ultimately, a joint management commission will have to have authority over shared water issues if it is to be effective.

Lesotho Highlands Development Authority Joint Permanent Technical Commission 1986. As part of the plan to develop the water resources in the Kingdom of Lesotho, Lesotho and South Africa agreed to a joint permanent technical commission (JPTC) to address issues of rural development, environmental protection, and technical issues related to construction. The problems described earlier have not been adequately addressed by the commission.

Tripartite Permanent Technical Committee 1983. South Africa, Mozambique, and Swaziland created a technical committee to address issues of concern on the Limpopo, Incomati, and Maputo rivers shared by the three nations. This committee has not functioned well in the past and does not appear to be capable in its current form of addressing the environmental issues related to flows through Kruger National Park. The ending of war in Mozambique and recent improvements in relations between Mozambique and South Africa offer the possibility that water issues can now be addressed explicitly and directly. Allocations of water to Mozambique should be negotiated with the impacts to Kruger National Park considered a fundamental constraint. Recently, there has been discussion of creating a "mirror" park to Kruger on the Mozambique side of the border. water for that park should also be guaranteed.

Other agreements. Several other agreements relevant to some of the water problems described above are in place. These include a Permanent Water Commission and a Joint Irrigation Authority for the Orange River basin, created by Namibia and South Africa in 1992, a water committee for the Southern African Regional Commission for the Conservation and Utilization of the Soil (SARCCUS); and a new water sector being created for the Southern African Development Community (SADC). The problem seems to be one of a lack of institutional authority and effectiveness, rather than lack of institutions themselves.

New South African water law principles. South Africa is currently rewriting its entire water law, replacing the 1956 law that was enacted and enforced by the apartheid regime. While most of the principles of the new law reflect domestic concerns, Principle 11 relates directly to shared water resources, and states: "International water resources, specifically shared river systems, shall be managed in a manner that optimizes the

benefits for all parties in a spirit of mutual cooperation. Allocations agreed for downstream countries shall be respected.” These principles were adopted by the South African Cabinet on November 20, 1996.

## **Middle East water politics and policy**

Existing institutions in the Middle East are not sufficient to design and implement the kinds of conflict resolution mechanisms described above. The United Nations has played an important role, through the International Law Commission, in developing guidelines and principles for internationally shared watercourses, but it should continue to press for the adoption and application of the principles in water-tense regions such as the Jordan and Euphrates river basins. Similarly, bilateral or multilateral river treaties have been effective in the past, but they need to consistently include all affected parties, they must include a joint management committee empowered to negotiate disputes, and they should be flexible enough to adapt to long-term changes in hydrologic conditions, such as those that may result from global climatic change. Finally, disputes over shared groundwater resources are particularly important in the Middle East, yet international groundwater law and principles are poorly developed. Some recent progress has been made, but more attention needs to be given to this in the context of the Middle East.

At the broadest level, the Middle East needs a comprehensive framework for planning and managing shared water resources. If necessary, such a framework could be convened by third-party nations and institutions, and would include regional and national studies on water supply and demand, the development of standards for the collection and dissemination of data, the establishment of Jordan and Euphrates river basin authorities that include all riparians, and the identification of mechanisms for implementing joint projects. Some of the goals of a framework water convention would include identifying minimum water requirements and the equitable allocation of water, water-use efficiency capabilities and goals, means for shifting water use within and among sectors, such as through water “banks” or marketing, and objectives for providing new supplies. The opportunity for conflict over water in the Middle East is high, but peaceful, effective cooperation remains a goal worth striving for.

## **Summary**

This paper offers a brief introduction to some of the international water issues most likely to affect international tensions and behavior worldwide, with specific reference to current issues in southern Africa and the Middle East. Because the waters of these regions are so widely shared and highly demanded, it seems likely that water-related disputes will grow in frequency and intensity in the future. Despite the wide acceptance of basic principles of behavior governing shared international watercourses, those principles are often ignored when narrow perceptions of national security are applied, when emergencies (such as droughts) occur, or when economic analyses of water projects are defined narrowly to exclude the social and environmental costs.

Because of recent political changes, southern Africa as a whole, and South Africa in particular, has the opportunity to do a number of things right. One of these is the

proper management of shared international water resources. Such management will require effective joint basin management of international rivers, the integration of environmental and social factors into estimates of the benefits and costs of physical infrastructure for water supply, and the more efficient use and allocation of existing water supplies. If strong efforts are made in these areas, the cooperative management of the shared waters of the region could benefit all parties.

These same principles govern problems in the Middle East. Considerable advances have been made with the signing of the Israeli-Jordanian peace treaty, which included specific recommendations for better allocation and sharing of water in the Jordan River basin. These advances need to be extended to the other parties that share the basin.

## References

- Breen, C. N. Quinn, and A. Deacon. 1994. *A description of the Kruger Parks Rivers Research Programme (Second phase)*. Pretoria, South Africa: Foundation for Research Development.
- Communiqué between Botswana and Namibia. 1996 (June 27). Okavango River communiqué, signed by D.N. Magang, minister of Mineral Resources and Water Affairs, Botswana, and N. Mbumba, minister of Agriculture, Water and Rural Development, Namibia.
- Conley, A.H. 1996. *A synoptic view of water resources in southern Africa*. Pretoria, South Africa: Department of Water Affairs and Forestry.
- Communiqué between Botswana and Namibia. 1996 (October 15). Namibian Okavango River - Grootfontein Pipeline Link, signed by M. Sekwale for Botswana and R. Fry for Namibia.
- Gleick, P.H. 1993. Water and conflict. *International Security* 18, no. 1, 79-112 (Summer 1993).
- Gleick, P.H. 1994. Water, war, and peace in the Middle East. *Environment* 36, no. 3, 6-on. Washington: Heldref Publishers.
- Heyns, P. 1995. Existing and planned water development projects on international rivers within the SADC region. Presented at the Conference of SADC ministers, Water resources management in southern Africa: A vision for the future. Pretoria, South Africa 23 November 1995.
- James, D. 1996. Water project strains relationship between Botswana and Namibia. *Republic of South Africa Star*, October 1, 1996.
- Lowi, M.R. 1990. The politics of water under conditions of scarcity and conflict: The Jordan River and riparian states. Ph.D. dissertation, Princeton University, 342.

- McCaffrey, S. 1993. International water law. In *Water in Crisis: A Guide to the World's Fresh Water Resources*, edited by P.H. Gleick. New York: Oxford University Press.
- Naff, T. 1992. The Jordan Basin: political, economic, and institutional issues. In *Country Experiences with Water Resources Management*, edited by G. LeMoigne. World Bank Technical Paper 175, 115-118.
- Ohlsson, L. 1995. Water and security in southern Africa. Department for Natural Resources and the Environment Publication on Water Resources no. 1. Stockholm: Swedish International Development Cooperation Agency.
- Peters, A. 1996. Southern Africa-Environment: Zambezi water turns hot. Inter Press Service. Internet archives (May 2, 1996).
- United Nations. 1978. *Registry of International Rivers*. Centre for Natural Resources, United Nations. New York: Pergamon Press.
- Venter, F.J. and A.R. Deacon. 1995. Managing rivers for conservation and ecotourism in the Kruger National Park" *Wat. Sci. Tech.* 32 No. 5-6, -227-233.
- Wallis, S. 1992. *Lesotho Highlands Water Project*. United Kingdom: Laserline Ltd.